

APPENDIX G - DESIGN APPENDIX

The first part of this appendix section presents the detailed feasibility level cost estimates generated for the recommended plan. A quantity and cost breakdown of the initial construction is presented. Also presented is a total cost estimate.

The quantity and cost breakdowns provide construction quantities, their unit costs, and the cost estimate for each aspect of site construction. The total cost sheet provides general site characteristics, a total project cost estimate, and the total unit cost per cubic yard of capacity. This total project estimate includes studies and construction costs, site development costs, site infrastructure and mitigation costs, future dike raising costs, and dredging, transportation, and placement costs.

The second portion of this appendix contains an analysis of the onsite borrow material available. For detailed discussion of geotechnical information, including borrow material, see Appendix H.

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Construction Element	Unit Cost	Units	Quantity	Cost
<u>DMCF Predredging</u>				
Mobilization/Demobilization	600,000 \$/Job		1	\$600,000
Mechanical Unsuitable Excavation/Placement @ HMI				
(2) Clamshell Dredges	6.72 \$/cy		1,730,000	\$11,625,600
Total				\$11,625,600
Supervision & Engineering	5,000 \$/d		43	\$212,500
Contingency Cost	20%			\$2,487,620
TOTAL Predredging Cost				\$14,925,720
<u>DMCF Initial Retention Structure Construction</u>				
Mobilization/Demobilization	3,000,000 \$/Job		1	\$3,000,000
Dike Construction/Fill (includes 25% construction loss)				
Hydraulic Sand Placement	4.00 \$/cy		1,500,000	\$6,000,000
Mechanical Clay Placement	8.08 \$/cy		436,500	\$3,526,920
Shoreline Dike	20.77 \$/cy		29,314	\$608,852
Dike Shaping	111.00 \$/lf		5,000	\$555,000
Supervision & Engineering	5,000 \$/d		61	\$303,500
Total			1,970,814	\$10,994,272
Stone Work				
Armored Sand Dike (Slope Armor)	39.00 \$/ton		48,000	\$1,872,000
Wet Basin Stone Dike Fill				
Wet Basin 500 lb. Armor Stone				
Cofferdam Construction				
Cofferdam Section	9,284,605 \$/Job		1	\$9,284,605
Road Stone	11.00 \$/sy		21,934	\$241,274
Spillways	200,000 \$/per		2	\$400,000
Geotextile				
Section 2 - Armored Sand Dike	4.00 \$/sy		41,028	\$164,112
Roadway	4.00 \$/sy		26,587	\$106,348
Total				\$270,460
Contingency Cost	20%			\$5,212,522
Initial Construction Cost				\$31,275,133
<u>Wet Basin Construction</u>				
Storm Drain Relocation (+30% Contingency)	3,500,000 \$/Job		1	\$3,500,000
Dike Construction and Fill (+30% Contingency)	3,800,000 \$/Job		1	\$3,800,000
Wet Basin Construction Cost				\$7,300,000
<u>Total Predredging and Construction Cost</u>				<u>\$53,500,853</u>

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Site Characteristics		
Item	Value	Units
Site Capacity	16.0	mcy
Site Effective Acreage	101	acres
Annual Placement	0.8	mcy
Site Life	20.0	years
Perimeter Dike	12,750	lf

Total Site Costs						
Item	Unit	Unit Rate	Quantity	Item Cost	Comments	
A. Initial Construction Costs				\$56,860,853		
Initial Construction Costs				\$53,500,853	Includes 20% Contingency	
Study/Design Costs				\$2,800,000	Feasibility and PED	
Study/Design Contingency		20%		\$560,000		
B. Site Development Costs				\$18,180,000		
Dredged Material Management	year	\$252,500	20.0	\$5,050,000	\$2,500 / acre	
Site Maintenance	year	\$255,000	20.0	\$5,100,000	\$20 / lf perimeter dike	
Site Monitoring and Reporting	year	\$250,000	20.0	\$5,000,000	Enviro Monitoring	
Contingency		20%		\$3,030,000		
C. Mitigation/Infrastructure Costs				\$29,000,000	From Study Team	
D. Dike Raising				\$19,875,600		
Common Borrow	\$/cy	\$15.00	752,000	\$11,280,000		
Dried Dredged Material	\$/cy	\$9.00	587,000	\$5,283,000		
Contingency		20%		\$3,312,600		
E. Dredging, Transportation, & Placement Costs				\$121,680,000		
Mob and Demob	year	\$750,000	20.0	\$15,000,000		
Dredging	mcy	\$2.25	16.0	\$36,000,000	Clamshell Dredging	
Transportation	mcy	\$0.90	16.0	\$14,400,000	\$0.10 / NM Haul Distance	
Placement	mcy	\$2.25	16.0	\$36,000,000	Hydraulic Unloader	
Contingency		20%		\$20,280,000		
Total Cost A+B+C+D+E				\$245,596,453		
Total Unit Cost				\$15.35 per cy		
Total Unit Cost Rounded				\$15.00 per cy		

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Appendix G - Borrow Analysis

An incremental borrow analysis was completed for the Masonville draft environmental impact statement (DEIS). The borrow analysis was performed using the borings from Findling (2005) and an applied area method. An applied area method uses areas of influence to weight the application of the boring results in developing volume estimates. The area of influence for each boring was established using the Thiessen Polygon Method (connection of perpendicular bisectors). Each boring shows both the type of material present and the depths at which it is found. The thickness of each type of material shown at a boring is applied to the boring's area of influence found through Thiessen Polygons to derive a volume for each material. This was done for each boring within the borrow area to the depth of -60 ft MLLW.

Table G-1 shows the material quantities calculated to be present at 5 ft depth increments from -15 ft to -60 ft MLLW for the West Borrow Area. An identical analysis was performed for the eastern borrow area. The borrow material available from the Eastern Borrow Area (Masonville DEIS Figure 4-14) was found to be all sand (70,000 cy).

Table G-1. Masonville West Borrow Area Dredging Depth Analysis

Elevation (ft MLLW)	Estimated Material Cut Volume (cy)							
	Upper Sand & Gravel	Silts & Soft Clay (Lost)	Stiff Clay (Borrow)	Lower Sand & Gravel	Red Clay (Borrow)	Total Sand & Gravel	Total Clay Borrow	Total Borrow
-15	21,918	0	0	0	0	21,918	0	21,918
-20	65,807	0	0	0	0	65,807	0	65,807
-25	142,411	0	0	0	0	142,411	0	142,411
-30	326,992	13,973	15,520	0	0	326,992	15,520	342,512
-35	507,827	21,574	49,544	21,153	3,872	528,980	53,417	582,397
-40	654,536	84,699	55,683	69,106	27,377	723,641	83,060	806,702
-45	734,281	130,520	71,742	161,190	84,266	895,471	156,008	1,051,479
-50	821,373	131,298	92,551	285,056	159,965	1,106,429	252,516	1,358,945
-55	909,010	131,298	95,487	399,708	263,529	1,308,718	359,015	1,667,733
-60	993,556	131,298	98,579	487,161	397,226	1,480,717	495,805	1,976,522

Notes:

1. If a boring stops above -60, all material below the bottom of the boring hole is assumed to be red clay.
2. Analysis does not include any environmental borings

Boring results showed that the sand and gravel borrow shown as available in the Table meets the criteria established in Findling 2005. Clay borrow was shown to meet the criteria necessary for the stability analyses performed (Findling 2005).

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